

WELL DECOMMISSIONING GENERAL PLANS AND SPECIFICATIONS

The following materials are acceptable for use in sealing abandoned wells, if placed according to the conditions described in the "Sealing Procedure."

MATERIALS

Fill Materials

Sand. Sand may be washed or pit run material containing gravel, cleaned of organic material such as twigs, leaves, and grass. No material over 1 1/2 inches in diameter will be used in 10" to 16" diameter wells. No material over 3 inches in diameter (cobbles or boulders) will be used in filling wells with diameters larger than 16".

Sealing Materials

Bentonite Chips. Use only commercially chipped sodium montmorillonite bentonite, which swells when wet, with a particle size of 1/4 to 3/4 inch. Bentonite chips should be screened over a 1/4" mesh screen before placing in the well to remove fine particles and dust.

Neat Cement. Neat cement is a mixture of one bag (94 pounds or 1 cubic foot) of portland cement and no more than 6 gallons of clean water. It is about the consistency of thick cream and can be pumped with special piston pumps. The mixture of one 94 pound bag of cement and six gallons of water yields a volume of approximately 1.3 cu. ft.

High Solids Bentonite Grout. This material is a commercially prepared blend of bentonite clays and powdered polymers when mixed with clean water forms a slurry with a minimum 20% solids by weight and a density of 9.4 lb/gal. The mixture should be prepared as directed by the manufacturer. The slurry sets to a low-permeable plastic grout that generates no heat of hydration and does not shrink during curing in the presence of moisture.

Concrete Grout. A mixture of cement, sand, and water in the proportion of one bag of portland cement, a cubic foot of dry, washed (not pit run) sand and 5 to 6 gallons of clean water.

Packaged, Dry, Combined Materials for Mortar. A commercially prepared mixture of cement and sand (Sakrete, Quikrete or equivalent) to which clean water is added according to the manufacturer's directions.

Native Clay. This can be any moist material of local origin found below the topsoil that has a medium or loamy texture (excluding sandy loam), according to USDA Textural Classification System, or is classified a silty clay (CL-ML) or lean clay (CL) in the Unified Soil Classification System. Fat Clay (CH) material is not acceptable because of difficulty in compacting.

SEALING PROCEDURE

If the permeability of the strata surrounding the entire depth of the well can be determined, the well may be filled with sealing material of equivalent or less permeability than those of the surrounding materials.

In the absence of a detailed analysis of the permeability of the strata surrounding the well, the following procedures and materials will be used based on the inside diameter of the well.

Step 1. Remove All Obstructing Materials from the Well.

Remove the pump and all internal pipe, obstacles and debris. If practical, the well should be flushed by pumping in water or by use of an air compressor line.

Step 2. Measure the Dimensions of the Well.

Determine the inside diameter and depth of the well and the depth to water. Determine the total volume of the cased well and the volume of water in the well by use of Table 1. If a well log is available, locate it for use in determining the geologic materials surrounding the well.

Table 1

| Hole diameter (inches) | Volume per foot of depth | |
|---------------------------|--------------------------|----------|
| | gal/ft | cu.ft/ft |
| 1 1/4 | .07 | .01 |
| 2 | .17 | .02 |
| 3 | .38 | .05 |
| 4 | 0.7 | 0.1 |
| 6 | 1.5 | 0.2 |
| 8 | 2.6 | 0.3 |
| 10 | 4.1 | 0.5 |
| 12 | 5.9 | 0.8 |
| 14 | 8.0 | 1.1 |
| 16 | 10.5 | 1.4 |
| 20 | 16.4 | 2.2 |
| 24 | 23.6 | 3.1 |
| 36 | 53.0 | 7.1 |
| 48 | 94.2 | 12.6 |

Step 3. Disinfect the Well.

To bring the well to a 100 parts per million chlorine concentration, one of the following formulas can be used:

1 gallon 5% chlorine bleach per 500 gallons of water

1 pint 5% chlorine bleach per 62 gallons of water

1.3 pounds high-test calcium hypochlorite tablets per 1000 gallons of water

Step 4. Fill the Well to Within Three Feet of Point Where Casing Will Be Cut Off.

The entire well depth shall be filled with sealing materials and or, alternately, with fill materials and sealing materials as described below. The method of filling and sealing will be based on the inside diameter of the well.

Small Diameter Wells - Under 4" - Figure 1

Small diameter wells will be sealed by a certified well driller (except by prior approval of the State conservation engineer) using:

Neat cement, concrete grout or high solids bentonite grout; tremied by pumping or by gravity from the bottom up in one continuous operation, raising the tremie pipe when necessary to overcome the hydraulic head of the grout, but keeping the bottom of the tremie pipe in contact with the

grout at all times. The tremie line shall be of such material as to assure that it reaches the bottom of the well.

Flowing wells with well diameters of less than 4 inches may be sealed according to this specification by certified well drillers if well flows do not exceed 5 gallons per minute. Sealing of wells with flows exceeding 5 gallons per minute may be approved by the State conservation engineer on a case-by case basis. Detailed plans for sealing methods and materials in these situations must be submitted to the State conservation engineer for prior approval.

Medium Diameter Wells - 4" to Less than 10" - Figure 2

Medium diameter wells can be sealed by use of **neat cement, concrete grout or high solids bentonite grout** as described in the Small Diameter Well section or:

Screened chipped bentonite; to be used only if well is not over 250 feet deep or there is less than 150 feet of water standing in the well. The chips shall be added at a rate not to exceed one 50-pound bag per 3 minutes, placed into standing water. If not enough water is contained in the well to saturate the bentonite chips, water should be added in the amount of approximately 5 to 8 gallons per 50-pound bag. When the sound of chips hitting water is no longer heard, water should be added.

Experience has shown that native clay, sand and gravel present bridging problems when placed in wells of less than 10" diameter. These materials will not be acceptable in medium diameter wells.

Large Diameter Wells - 10" or Larger - Figures 3A, 3B, 3C

In large diameter wells obtain a water level reading before flushing or wait 24 hours after flushing for the water level to stabilize. After sanitizing, the well shall be filled with **screened chipped bentonite, neat cement, concrete grout or high solids bentonite grout** as described in the Small and Medium Diameter Well sections.

A more economical method can be used to reduce the volume of sealing materials required to decommission a large diameter well.

Sand fill material may be placed in the well to a point 1.5 feet below the pre-determined static water level (see Figure 3A). These materials shall be shoveled into the well casing. Materials dumped from a bucket loader or truck box may bridge in the well. A minimum of 3 feet of sealing materials shall then be placed using methods described in the Small and Medium Diameter Well sections to form a positive seal at the water level.

The placement of sealing materials may extend to within 3-feet of the top of the planned casing cut off point or the placement of sand fill materials may be resumed. Above the positive seal, 12-inch layers of sealing material must be alternated at 10-foot intervals with the sand to within 3-feet of the planned casing cut off point (Figure 3B).

If the well is dry and has been dry for many years, the positive seal at ground water level can be omitted.

Native clay (Figure 3C) may also be used as a sealing material from no more than 12 feet below the ground surface to the planned casing cut-off point. It must be slightly to moderately moist and be tamped in one foot layers by use of 2" x 4" board or other device to obtain good compaction. Native clay shall not be placed into standing water.

Step 5. Place the Top Seal on the Well and Remove A Minimum of 3 Feet of Casing.

All wells, except large diameter wells sealed with Native Clay, shall have a top seal of neat cement, concrete grout or packaged, dry, combined materials for mortar (Quikrete or equivalent). A minimum of 3-feet of these materials shall be placed in the casing interval below the planned cut off point.

Placement of the top seal materials shall not proceed until a minimum of one hour has elapsed, after placement of the fill/sealing materials, to allow for potential settlement. Top seal materials shall not be placed until settlement in the casing has stabilized. Any voids created by the settlement should be filled by placement of appropriate fill/sealing materials.

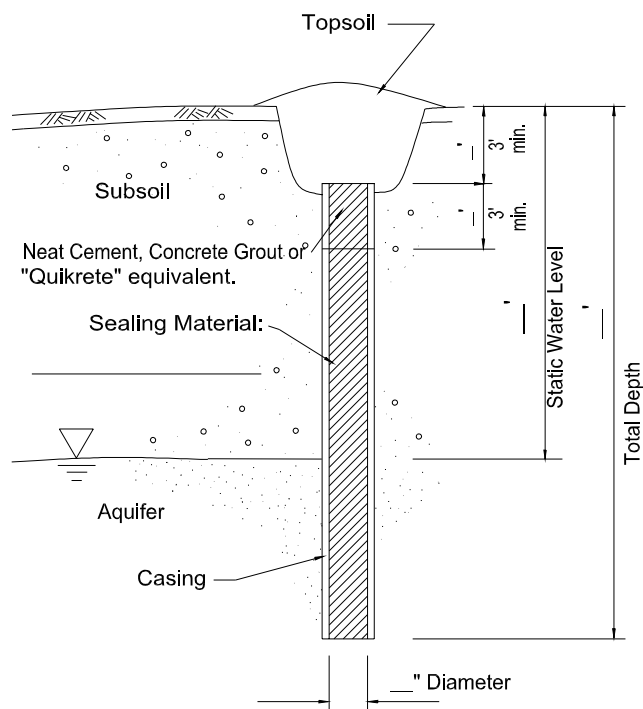
High water levels may prevent the placement of a full 3-foot top seal. Effort should be made to place as much of the top seal as is allowed by the site conditions.

Remove a minimum of three feet of casing to minimize cracking of the sealing material due to frost. Under certain site conditions, such as a well located in a basement, the casing does not have to be cut off, but should be sealed to the top of the casing.

Step 6. Fill From Top of Cut Off Casing to Surface.

The void area around and above the cutoff casing shall be filled with topsoil, mounded on top so that surface water will not pond on the site. If the site is in a building or other site where soil is not an appropriate fill, but casing has been cut off below the surface, any non-settling low-permeable material may be used.

If the decommissioned well is located in a well pit to be abandoned, perforate the floor, knock in at least one wall and fill the pit and all void spaces with native clay topped with topsoil.



WELL CROSS SECTION

NOTES:

1. The well shall be cleared of all foreign material, including pumping equipment, valves, pipelines and casing liners, then sanitized.
2. Existing Casing Material Type or Schedule and Length: _____
3. Sealing Material (circle type to be used):
 a) Neat Cement
 b) Concrete Grout
 c) High Solids Bentonite Grout
4. If more than one sealing material is used, show depth of materials on cross section.
5. Place sealing material from the bottom of the well upward using a tremie pipe to ensure continuous placement without bridging.
6. Cut off casing 3 ft. below ground surface. If well is located in a basement or pit, casing does not have to be cut off.
7. Inspect periodically to ensure the mound and adjacent areas have not settled or eroded, and maintain to prevent ponding above the site.
8. Date of Well Decommissioning: _____
9. Name of Certified Well Driller: _____

TABLE OF ESTIMATED QUANTITIES

| ITEM | UNIT | AMOUNT |
|------|------|--------|
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| | | |
| | | |

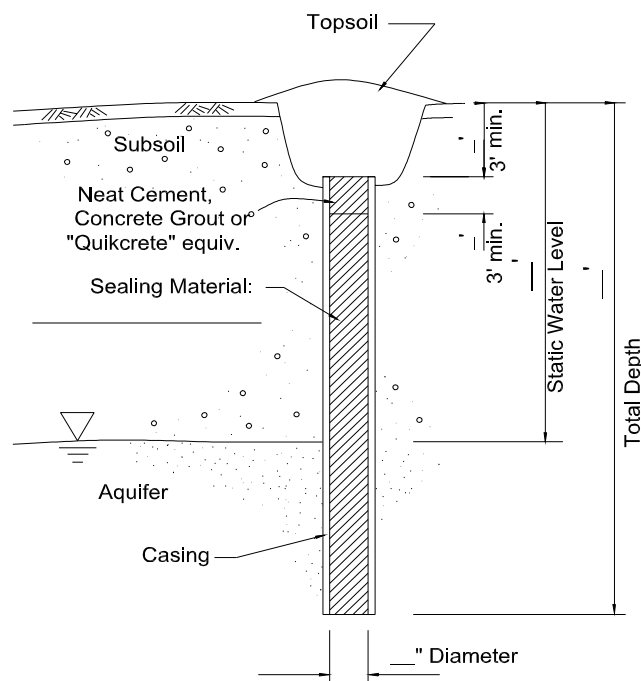
NOT TO SCALE

DECOMMISSIONING ABANDONED WELLS
LESS THAN 4-INCH DIAMETERU. S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

| | | |
|----------------|-------------|-------------------|
| Designed _____ | Date _____ | Approved By _____ |
| Drawn _____ | Date _____ | Title _____ |
| Traced _____ | Sheet _____ | Drawing No. _____ |
| Checked _____ | No. _____ | FIGURE 1 |

Standard Drawings shall not be altered
without State Conservation Engineer Approval.

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WELL CROSS SECTION

NOTES:

1. The well shall be cleared of all foreign material, including pumping equipment, valves, pipelines and casing liners, then sanitized.
2. Existing Casing Material Type or Schedule and Length: _____
3. Sealing Material (circle type to be used):
 - a) Neat Cement
 - b) Concrete Grout
 - c) High Solids Bentonite Grout

The following may only be used if well is less than 250 feet deep and has less than 150 feet. of standing water.

 - d) Bentonite chips 1/4 to 3/4 inch dia. (screen to remove dust and fine particles before placing)
4. If more than one sealing material is used, show depth of materials on cross section.
5. Place sealing material from the bottom of the well upward using a tremie pipe as needed, to ensure continuous placement without bridging. If chips are used they may be poured in from the top - slowly.
6. Top with neat cement, concrete grout or "Quikrete" equivalent a minimum of 3 feet below planned cut off point.
7. Cut off casing 3 ft. below ground surface. If well is located in a basement or pit, casing does not have to be cut off.
8. Inspect periodically to ensure the mound and adjacent areas have not settled or eroded, and maintain to prevent ponding above the site.
9. Date of Well Decommissioning: _____

TABLE OF ESTIMATED QUANTITIES

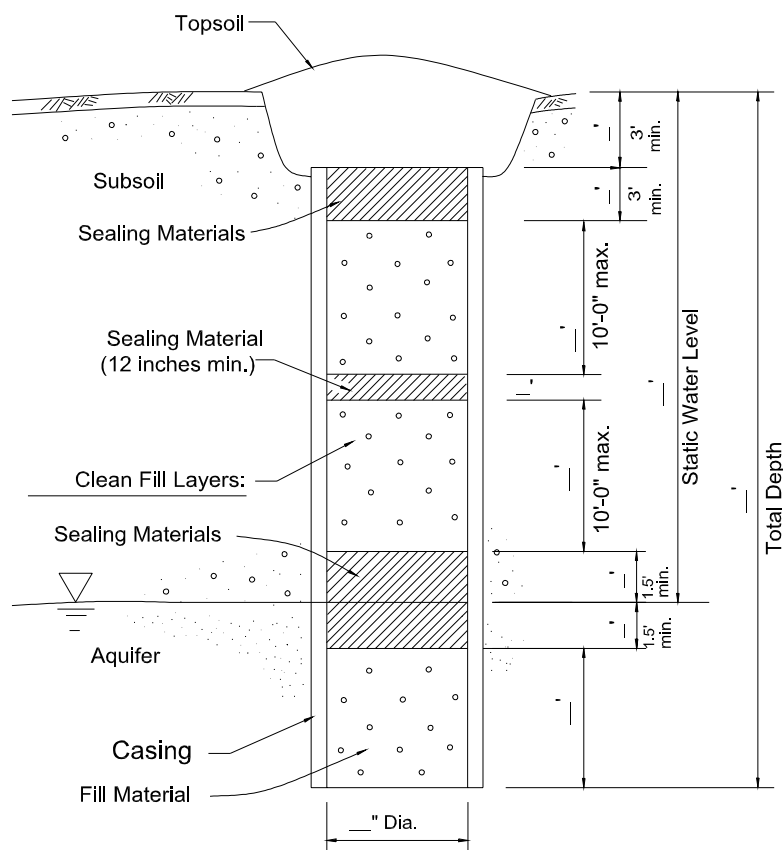
| ITEM | UNIT | AMOUNT |
|------|------|--------|
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| | | |

NOT TO SCALE

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|--|------------|-------------------|-------------|
| DECOMMISSIONING ABANDONED WELLS 4-INCH TO LESS THAN 10-INCH DIAMETER | | | |
| U. S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE | | | |
| Designed _____ | Date _____ | Approved By _____ | Title _____ |
| Drawn _____ | Date _____ | Traced _____ | Sheet _____ |
| Checked _____ | of _____ | Drawing No. _____ | FIGURE 2 |

Standard Drawings shall not be altered
without State Conservation Engineer Approval.

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WELL CROSS SECTION

NOTES:

1. The well shall be cleared of all foreign material, including pumping equipment, valves and pipelines, then sanitized.
2. Existing Casing Material Type or Schedule and Length:
3. Place fill at the bottom of the well to within 1.5ft. of water level.
4. Clean Fill Material; free of all foreign matter (circle)
 - 1) Sand 2) Sand-Gravel Mix
5. Sealing Material (circle type to be used)
 - a) Neat Cement
 - b) Concrete Grout
 - c) High Solids Bentonite Grout
 - d) Bentonite Chips, 1/4 in to 3/4 in. (screen to remove dust and fine particles before placing).
6. If more than one sealing material is used, show depth of materials on cross section.
7. Top with neat cement, concrete grout or "Quikrete" equivalent a minimum of 3 feet below planned cut off point.
8. Cut off casing a minimum of 3 ft. below ground surface. If the well is in a basement or pit, casing does not have to be cut off.
9. Inspect periodically to ensure the mound and adjacent areas have not settled or eroded, and maintain to prevent ponding above the site.
10. Date of Well Decommissioning: _____

TABLE OF ESTIMATED QUANTITIES

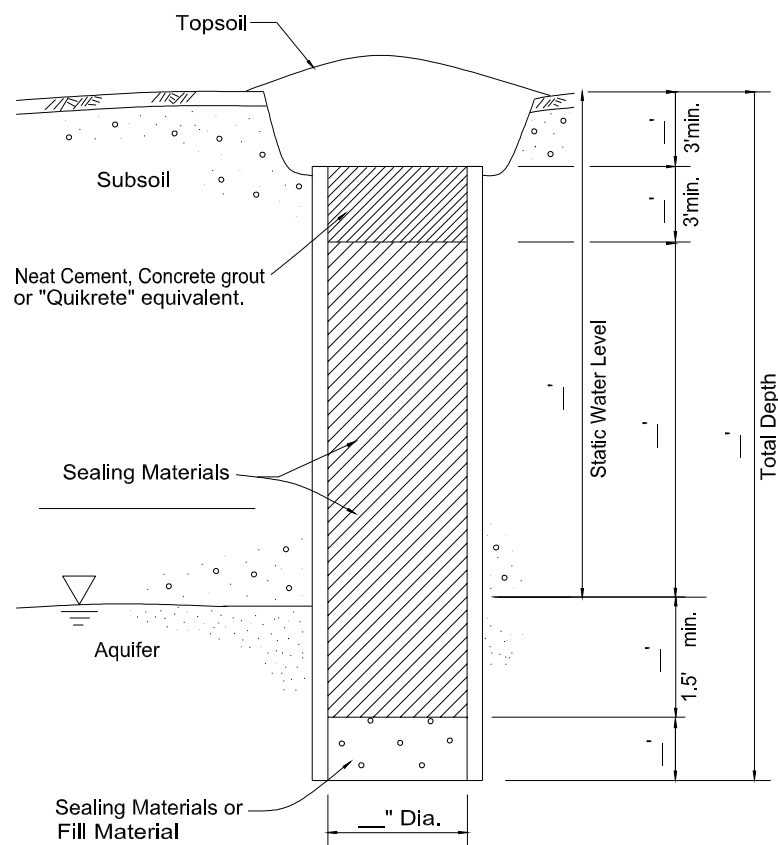
| ITEM | UNIT | AMOUNT |
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NOT TO SCALE

| | |
|---|-------------------|
| DECOMMISSIONING ABANDONED WELLS | |
| 10-INCH OR LARGER DIAMETER | |
| CASE B: SAND FILL WITH INTERMEDIATE PLUGS | |
| U. S. DEPARTMENT OF AGRICULTURE | |
| NATURAL RESOURCES CONSERVATION SERVICE | |
| Designed _____ | Date _____ |
| Drawn _____ | Approved By _____ |
| Traced _____ | Title _____ |
| Checked _____ | Date _____ |
| Sheet _____ | Drawing No. _____ |
| No. _____ | FIGURE 3B |

Standard Drawings shall not be altered
without State Conservation Engineer Approval.

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WELL CROSS SECTION

NOTES:

- The well shall be cleared of all foreign material, including pumping equipment, valves and pipelines, then sanitized.
- Existing Casing Material Type or Schedule and Length: _____
- Clean Fill Material; free of all foreign matter (circle)
1) Sand 2) Sand-Gravel Mix.
- Sealing Material (circle type to be used):
a) Neat Cement
b) Concrete Grout
c) High Solids Bentonite Grout
d) Bentonite Chips, 1/4 in. to 3/4 in. (screen to remove dust and fine particles before placing).
- If more than one type of sealing or fill material is used, show the type and depth of each layer on the cross section.
- Top with neat cement, concrete grout or "Quikrete" equivalent a minimum of 3 feet below planned cut off point.
- Cut off casing a minimum of 3 ft. below ground surface.
If well is located in a basement or pit, casing does not have to be cut off.
- Inspect periodically to ensure the mound and adjacent areas have not settled or eroded, and maintain to prevent ponding above the site.
- Date of Well Decommissioning: _____

TABLE OF ESTIMATED QUANTITIES

| ITEM | UNIT | AMOUNT |
|------|------|--------|
| | | |
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| | | |

NOT TO SCALE

DECOMMISSIONING ABANDONED WELLS
10-INCH OR LARGER DIAMETER
CASE A: CONTINUOUS SEAL ABOVE SCREEN

U. S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

| | | |
|----------------|-------------|-------------------|
| Designed _____ | Date _____ | Approved By _____ |
| Drawn _____ | Title _____ | |
| Traced _____ | Date _____ | |
| Checked _____ | Sheet _____ | Drawing No. _____ |
| | of _____ | FIGURE 3A |

Standard Drawings shall not be altered
without State Conservation Engineer Approval.

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